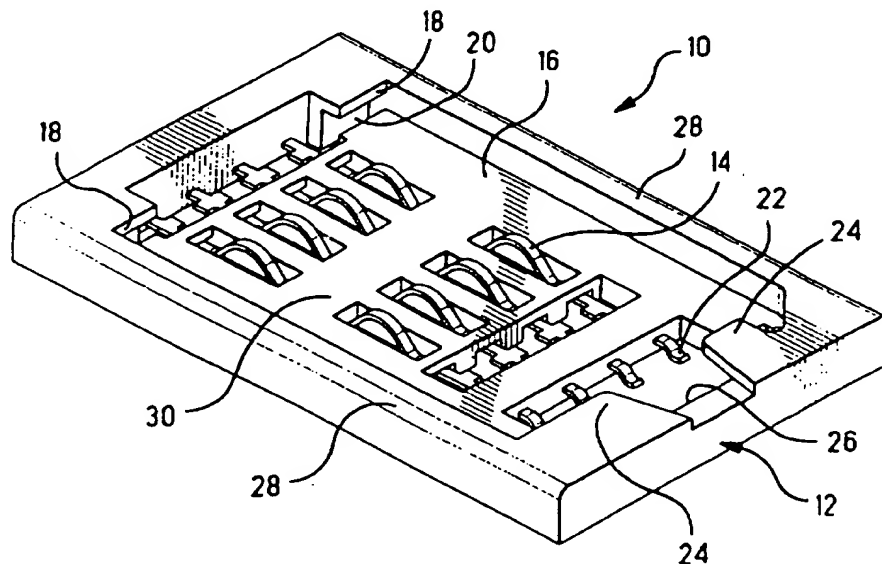




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(21) International Application Number: PCT/US97/16981 (22) International Filing Date: 24 September 1997 (24.09.97) (30) Priority Data: 60/027,267 26 September 1996 (26.09.96) US (71) Applicant: THE WHITAKER CORPORATION [US/US]; Suite 450, 4550 New Linden Hill Road, Wilmington, DE 19808 (US). (72) Inventors: BROSHARD, John, L., III; 1720 Tenby Drive, Hershey, PA 17033 (US). HYLAND, James, H.; 6 Mayapple Drive, Hummelstown, PA 17036 (US). (74) Agents: ANASTASI, Salvatore et al.; The Whitaker Corpora- tion, Suite 450, 4550 New Linden Hill Road, Wilmington, DE 19808 (US).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, UZ, VN, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: ELECTRICAL CONNECTOR FOR RECEIVING A PLANAR ELECTRONIC MODULE

**(57) Abstract**

An electrical connector (10) is provided for receiving a planar electronic module (32), for example a SIM, having an insulative housing (12) with an initial insertion slot (20) at a first end to receive the module (32) edge at an acute angle to the mating face (16) and locking tabs (18) at a second end remote from the first end to hold the module (32) in a parallel orientation with respect to the mating face (16), whereby the module (32) is first inserted into the first end then rotated toward the mating face (16), then transversely slid along the mating face (16) towards the locking tabs (18) so as to achieve a wiping action and lock the module (32) under the locking tabs (18).

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ELECTRICAL CONNECTOR FOR RECEIVING A PLANAR ELECTRONIC MODULE

This invention is related to electrical connectors and more particularly to an electrical connector for receiving a planar electronic identification module.

Subscriber identification modules (SIMs) are well known in the communications industry. They are small electronic cards, approximately 25 x 15 mm, which contain information to specifically identify a subscriber, for example a telephone subscriber. The SIMs are read by electronic devices such as telephones and allow a particular user to access the device.

Electrical connectors have been provided in these electronic devices for reading SIMs. One example of such a connector is disclosed in U.S. Patent No. 5,320,552 by Reichardt et al. This patent teaches a contacting apparatus 2 having a housing 3 which supports a series of electrical contacts 8 and a receiving slot 7 for a SIM. Abutment means are also provided on the support arm 4 which is adapted to hold the SIM 1 in the housing 3. The support arm 4 is best shown in Figure 1 and is depressed as the SIM 1 is inserted into the housing 3. The support arm 4 returns back to its relaxed position once the SIM 1 is fully inserted into the housing 3 and captivated in the support arm 4 by engagement with the engagement surface 21.

Electrical connectors for connecting SIMs to devices have been developed. One example of such a connector is shown by Duffet et al. in U.S. Patent No. 5,224,873 which teaches a connector for an electronic card. The connector has a frame with a groove adapted to receive a first side of the card. Two elastic mobile parts are provided to press the card against a series of caps and a retainer once the card is rotated into its fully inserted read position. A problem arises in such connectors because it is difficult to remove the card by elastically deforming the retainer in order to release

the card from the read position. Another problem exists in that there is little or no wiping action between the contacts and the pads of the SIM upon mating. Any dirt or debris that is present on the SIM pads or the contacts upon insertion may adversely affect the electrical connection therebetween.

It is therefore an object of this invention to provide an electrical connector which offers ease in mating and unmating of a SIM or like module to the connector and also prevents poor electrical connections due to the effects of debris between the contacts and the pads of the module.

The object of the invention has been achieved by providing an electrical connector for receiving a planar electronic module, for example a SIM, having an insulative housing with an initial insertion slot at a first end to receive the card edge at an acute angle to the mating face and locking tabs at a second end remote from the first end to hold the card in a parallel orientation with respect to the mating face, whereby the module is first inserted into the first end then rotated toward the mating face, then transversely slid along the mating face towards the locking tabs so as to achieve a wiping action and lock the module under the locking tabs.

The invention will now be described by way of example with reference to the accompanying figures of which:

Figure 1 shows a three-dimensional view of the electrical connector according to this invention.

Figure 2 shows a top view of the electrical connector of Figure 1.

Figure 3 shows a cross sectional view taken along the line 3-3 of Figure 2.

Figure 4 shows a cross sectional view similar to that of Figure 3 taken along the line 3-3 of Figure 2

and having a module inserted and rotated into a read position.

Figure 5 shows a cross sectional view of the electrical connector taken along the line 3-3 of Figure 2 and having a module rotated into the read position and translated to the locked position.

Figure 6 shows a three-dimensional view of an alternate embodiment of the electrical connector.

Figure 7 shows a three-dimensional view of a second alternate embodiment of the electrical connector according to this invention.

Figure 8 shows a top view of the electrical connector shown in Figure 7 with a module inserted.

Figure 9 shows a cross sectional view taken along the line 9-9 of Figure 8 as the slide bar makes initial contact with an inserted module.

Figure 10 shows a cross sectional view similar to Figure 9 with the module in the read position and the bar in the locked position.

Figure 11 shows a three dimensional view of a third alternate electrical connector according to this invention.

Figure 12 shows a three dimensional view similar to that of Figure 11 with the slide bar in the module release position.

The electrical connector 10 according to this invention will now be described in general with reference to Figure 1. The electrical connector 10 is formed from an insulative housing 12 having electrical contacts 14 inserted therein by conventional means. The insulative housing 12 is profiled to have two projections 24 extending from a stop wall 26. The electrical contacts 14 are mounted in the housing 12 in openings along the mating face 16. A module receiving slot 20 (Fig. 5) is formed by the space between the projection 24 and the mating face 16. Sidewalls 28 extend upwardly from the mating face 16 to form a module

receiving cavity 30 in the connector 10. Locking tabs 18 are located at an end opposite from the projections 24 and extend from each of the sidewalls 28 towards the center of the housing 12. The contacts 14 are designed for surface mounting to a board and therefore are provided with surface mount tails 22.

Insertion and connection of a module 32 will now be described in greater detail with reference to Figures 3 to 5. As shown in Figure 3, a module 32 such as a SIM is first inserted into the card receiving slot 20 at an acute angle to the mating face 16. It should be noted at this point that the module 32 is captive against the stop wall 26, the projections 24, and the mating face 16. It should also be noted that there is sufficient clearance for the module 32 to enter the card receiving cavity 30 without touching the locking tabs 18. At this point, the module 32 is rotated in the direction indicated by the arrow marked R towards its read position. The rotating motion causes the projections 24 to flex away from the mating face 16. Figure 4 shows the module 32 after rotation and in the read position being captivated between the projection 24, the mating face 16 and the stop wall 20. The module 32 may then be simply depressed along its top surface and transversely slid in the direction marked by the arrow T in Figure 4 towards the locking tabs 18 thus allowing the projections 24 to return to their relaxed position. Figure 5 shows the module 32 in its fully locked read position such that the module 32 is captivated by dimples 27 on the inner surface of the projections 24, locking tabs 18, and the mating face 16. It should also be noted that a wiping action has occurred along the pads of the module 32 as it was transversely slid in the direction of the arrow T. Removal of the module 32 can be accomplished by simply depressing the top surface of the module 32 and transversely sliding it in the direction opposite the arrow T towards the stop wall 20

and then releasing the top surface of the module 32 which causes the loaded contacts 14 to exert an upward force on it thus urging it towards the initial position shown in Figure 3.

5 Figure 6 shows a first alternate embodiment of the electrical connector 10' having the same housing 12 with the addition of a slide assist spring 40 which is disposed at an end of the connector adjacent to the projections 24. The slide assist spring 40 serves to
10 aid in insertion of a module 32 into the connector. It should be recalled from Figure 5 that insertion of the module 32 into the connector 10 requires a simple transverse sliding motion of the module 32 towards the locking tabs 18. The slide assist spring 40 serves to
15 bias the module 32 towards the locking tabs 24 in order to overcome the initial frictional force which holds the it in contact with the mating face 16.

Referring now to Figure 7, a second alternate embodiment of the electrical connector 110 is shown.
20 The alternate insulative housing 112 features a wall 120 at one end of a module receiving cavity 130 and similar projections 24 at the opposite end of the card receiving cavity 130. A slide bar 50 is also provided which extends over the open side of the module receiving
25 cavity 130 and around the sidewalls 128 of the insulative housing 112. The slide bar 50 is profiled to grip the side walls 128 with arms 53 each having dimples 54 (Fig. 8) formed on inner surfaces thereof. A depression 51 is formed in the center of the slide bar
30 approximately half way between each of the side walls 128. The slide bar 50 is designed to slidably engage the side walls and be movable along a desired length of the side walls 128. As best seen in Figure 8, the slide bar 50 is in its open position when dimples 54 are
35 engaged into detents 52 of the side walls 128. At this point, a module 32 may be inserted under the projection 24 at an acute angle to the mating face 16 (Fig. 9).

The slide bar 50 is then urged in the direction of the arrow T' until it engages the module 32 (Fig. 9) and then is further urged in the direction T' such that it presses the module 32 into engagement with electrical contacts 14 and the mating face 16 (Fig. 10). Dimples 55 will engage detents 56 of the side walls 128 in order to lock the slide bar 50 into a fully mated position (Fig. 10).

It should also be noted that the depression 51 is now located in the center of the module 32 in order to depress its pads on to the electrical contacts 14 for a better electrical connection. It should be noted that this embodiment of the connector 110 is more suitable for applications where less wipe is desired between the contacts and the module in order to minimize the wear of the pads. A minimized wiping action will occur as the slide bar 50 is urged to the locked position.

Figure 11 shows a third alternate embodiment of the electrical connector 10'' having a slide bar 50'' to assist releasing the module (not shown here) from the latching mechanism 100. The slide bar 50'' is equipped with a pair of release projections 101 disposed along its top surface and extending towards the mating face 16'' of the housing 12''. The latching mechanism 100 is located on the latching end 104 of the insulative housing 12''. The mechanism 100 is profiled to have a main body 102 and a pair of latching arms 106 extending from the body 102 along and spaced from the latching end 104. A module is insertable into the insertion groove 20'' at an acute angle to the mating face 16'' and then rotatable toward the mating face 16 into latching engagement with the latching mechanism 100. The slide bar must initially be in an open position, that is to the far left side as viewed in Fig. 11, in order to insert the module, but then may be moved along the side walls 28'' without affecting the latched module. In order to remove the card, the slide bar 50'' is slid to its release position (Fig. 12). In this position the

release projections 101 urge the latching arms 106 toward the latching end 104 to release the module from the latching arms 106.

5 It should be understood by those reasonably skilled in the art that various combinations of features disclosed in each of the alternative embodiments can easily be adaptable to the other alternate embodiments while keeping within the spirit of the invention. For example, the depression 51 of the second alternate
10 embodiment shown in Figure 7 could easily be utilized in the third alternate embodiment of Figure 11. Also the locking tabs 18 of the first embodiment of Figure 1 could be incorporated into the design of the second alternate embodiment of Figure 7. Other combinations
15 will be readily available to those reasonably skilled in the art.

The advantage of this invention is that it provides a simple easily matable and unmatable electrical connector that offers a wiping action between the
20 contacts and the pads of a module. An additional advantage of this invention is that it provides a module connector having relatively easy mating and unmating actions.

WE CLAIM:

1. An electrical connector 10 for rotatably receiving a planar electronic module 32 having an
5 insulative housing 112 having side walls 128 and being profiled to receive electrical contacts 14 on a module mating face 16, the housing 112 having a module receiving slot formed by a tab 24 extending from a stop wall 26 at a first end, the connector 10 being
10 characterized by:
a slide bar 50 slidably attached to the housing 112 and extending over an open end thereof, the slide bar 50 being spaced from and substantially parallel to the mating face 16.
15
2. The electrical connector 10 according to claim 1 wherein the slide bar 50 is further characterized by side arms 53 extending from a top surface for engagement with the side walls 128 of the housing 112.
20
3. The electrical connector 10 according to claim 2 wherein the slide bar 50 is further characterized by at least one dimple 54 formed on an inner surface of at least one of the side arms 53.
25
4. The electrical connector 10 according to claim 3 wherein at least one depression 52 is formed in at least one of the side walls 128 for receiving the at least one dimple 54 of the slide bar 50 whereby the
30 slide bar 50 is latchable in a desired position.
5. The electrical connector 10 according to claim 2 wherein a depression 51 is formed in the top surface of the slide bar 50 and extends therefrom toward the
35 mating face 16 of the housing 112.

6. An electrical connector 10 for rotatably receiving a planar electronic module 32 having an insulative housing 12 profiled to receive electrical contacts 14 on a card mating face 16, and to have a
5 module receiving slot formed by a tab 24 extending from a stop wall 26 at a first end and a locking projection 18 at a second end opposite the first end, characterized in that:

the locking projection 18 is spaced a distance
10 apart from the stop wall 26 such that said distance is greater than the length dimension of the module 32, the module 32 being insertable into said module receiving slot at an acute angle to the mating face 16, then
15 rotatable to a position substantially parallel with the mating face 16, and linearly translated along the mating face 16 into locking engagement with said locking projection 18.

20

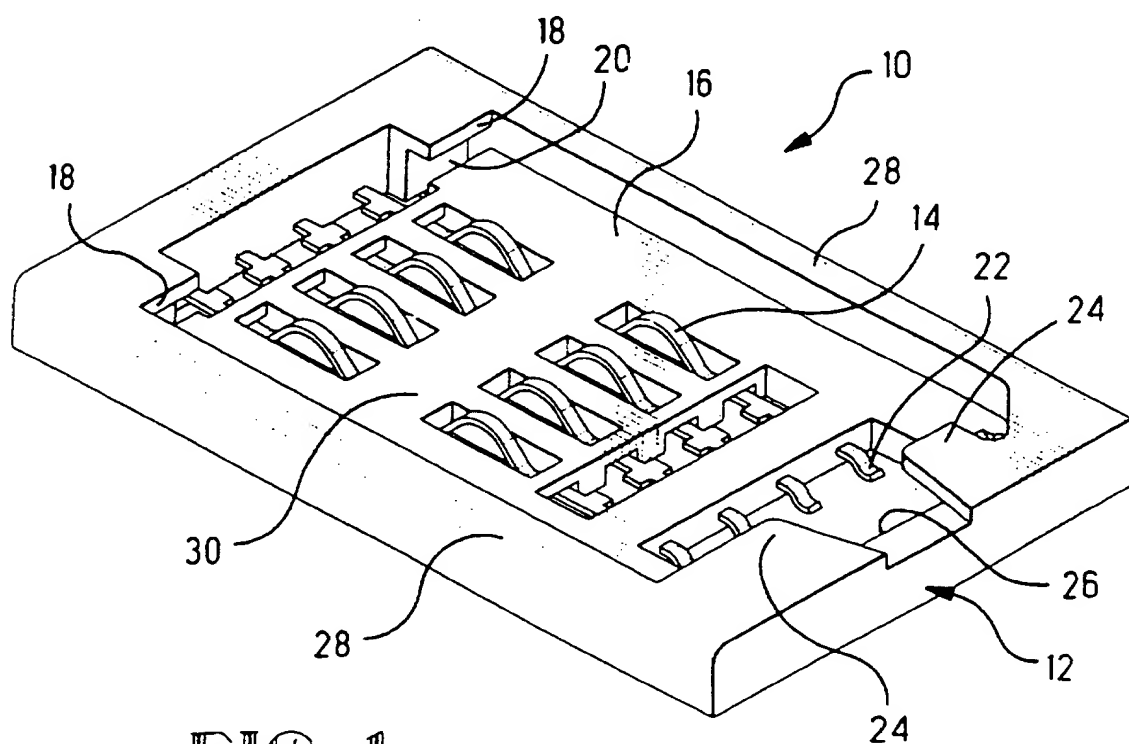


FIG. 11

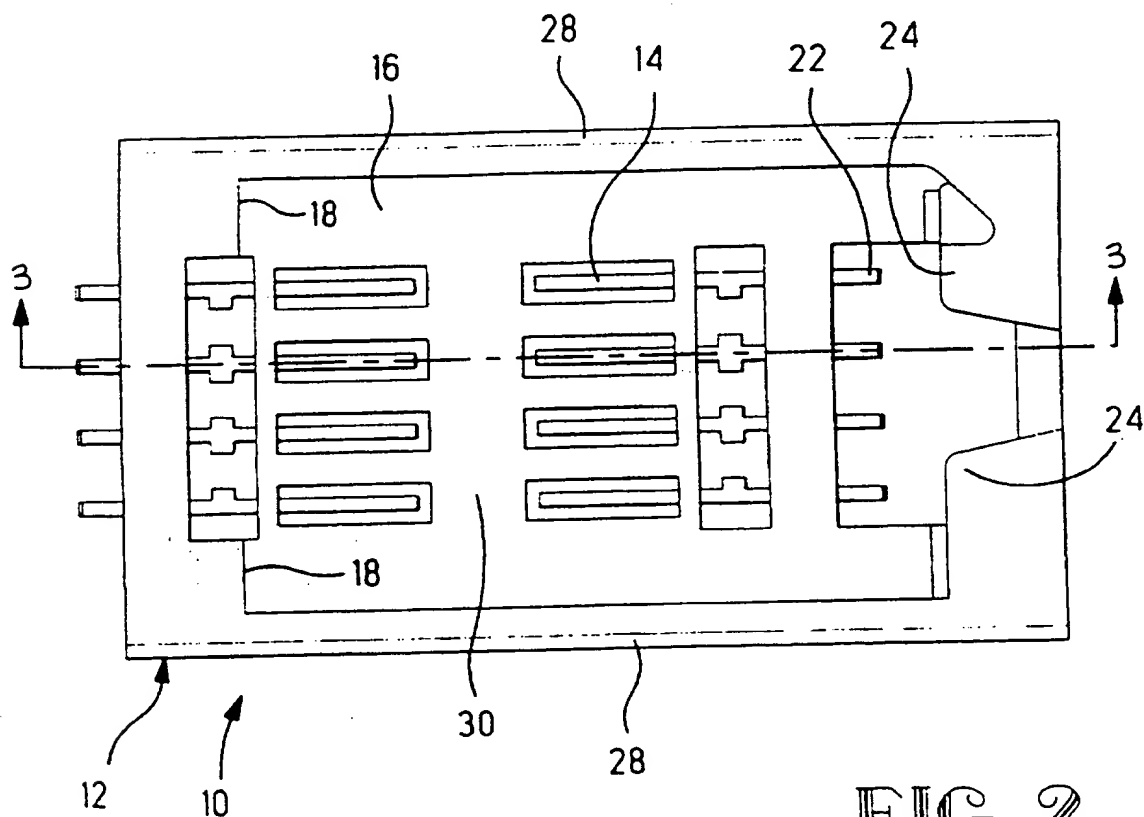


FIG. 2

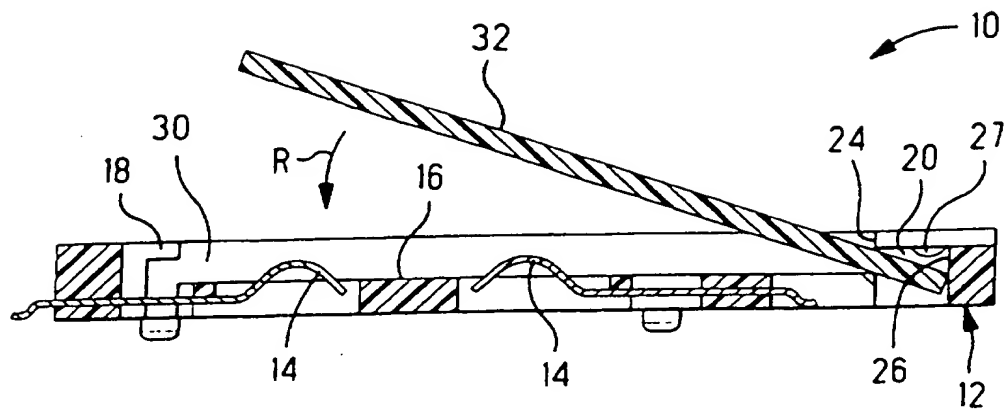


FIG. 3

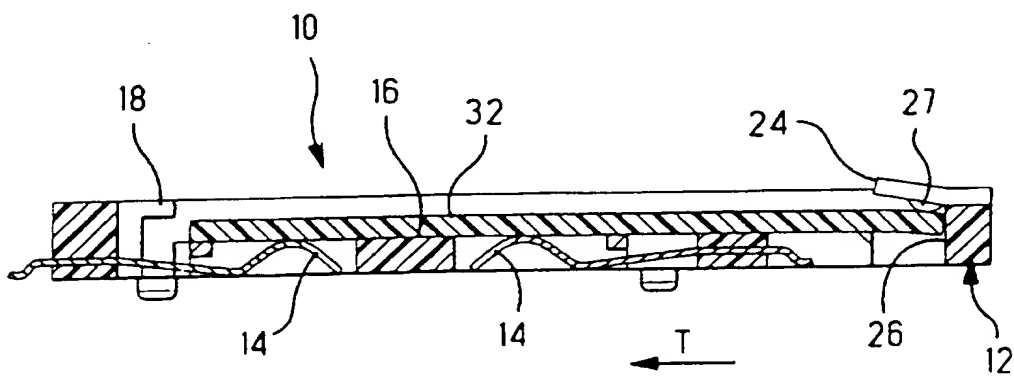


FIG. 4

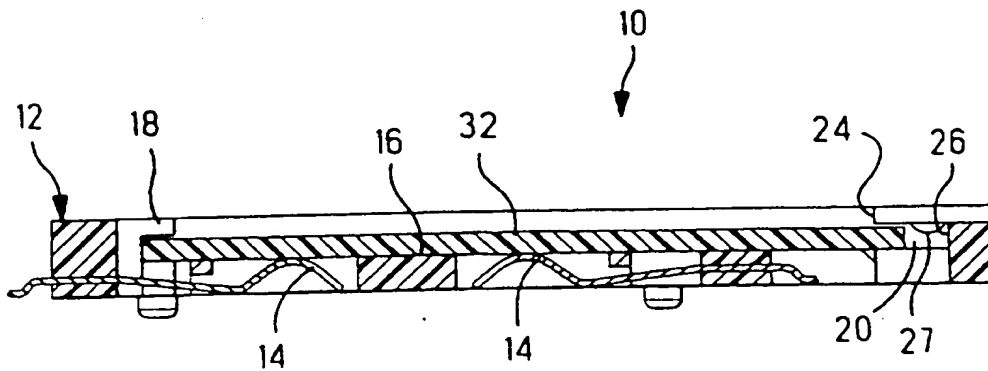


FIG. 5

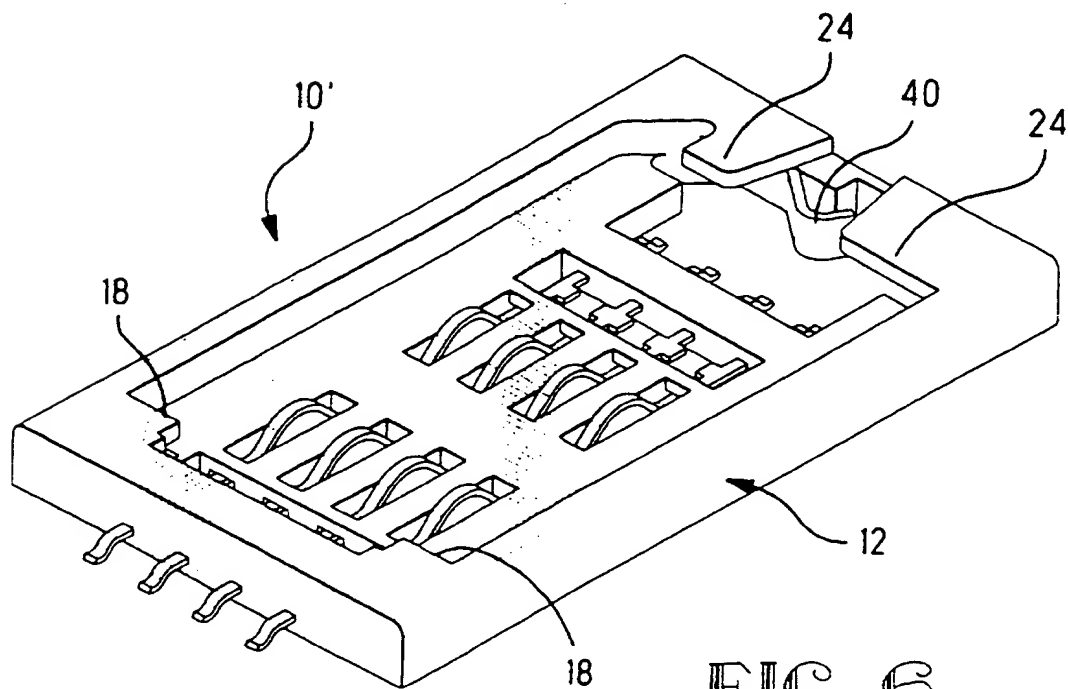


FIG. 6

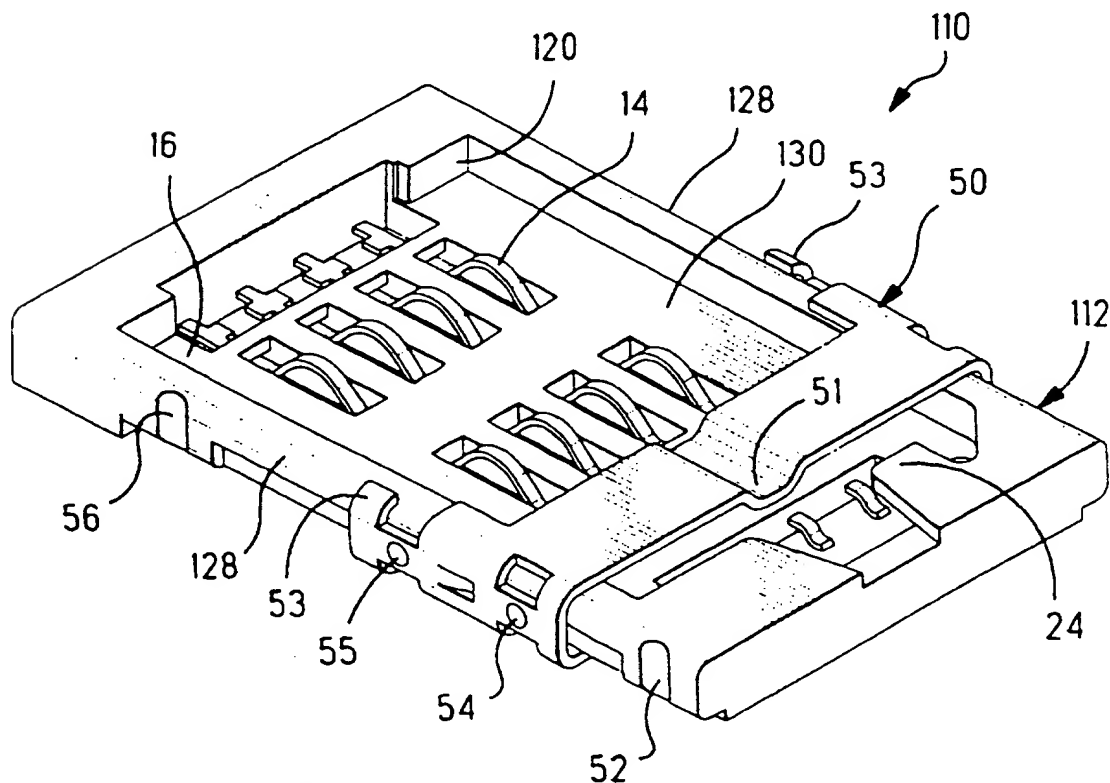


FIG. 7

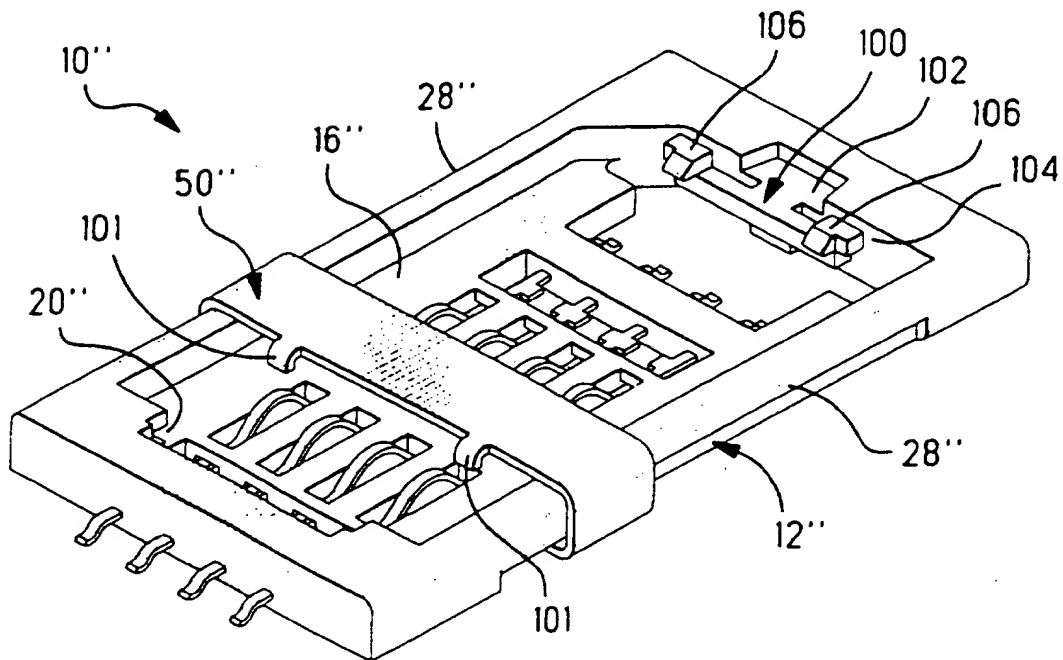


FIG. 11

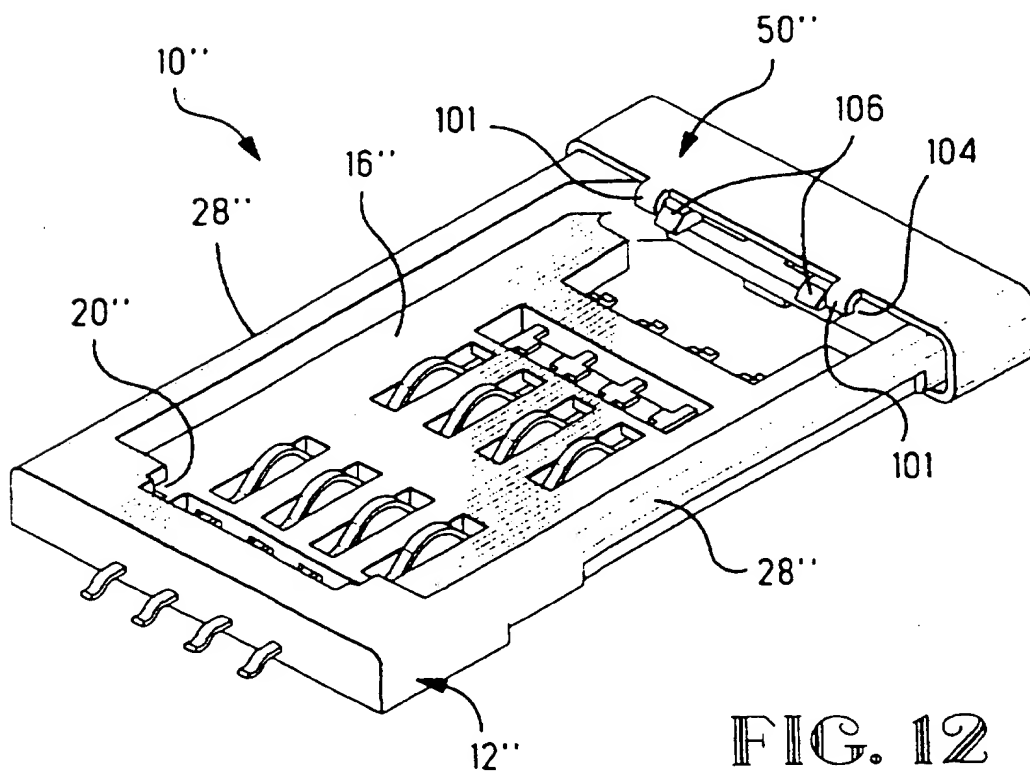


FIG. 12

INTERNATIONAL SEARCH REPORT

Intern at Application No
PCT/US 97/16981

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G06K7/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 224 873 A (DUFFET ET AL.) 6 July 1993 cited in the application see abstract; figure 2	1,6
A	GB 2 258 748 A (HALPERN JOHN WOLFGANG ;WARD WILLIAM (GB); COUSINS STEVEN (GB)) 17 February 1993 see page 3, paragraph 2 - page 4, paragraph 1; figures 5,6	1,6
A	EP 0 660 457 A (OKI ELECTRIC INDUSTRY COMPANY, LIMITED) 28 June 1995 see column 5, line 10 - line 45; figure 4	1,6

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

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Information on patent family members

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